

Chapter 4

ENVIRONMENTAL CONSEQUENCES

Introduction

This chapter will compare the No Action conditions of the resources with the impact of Reclamation's proposed action. The resources evaluated are vegetation, fish, wildlife, threatened and endangered species, economics, recreation, irrigated agriculture, historic resources, traditional cultural properties, Indian trust assets, environmental justice, surface water quality, groundwater quality, Native American sacred sites, visual quality, air quality, soils, and social environment.

Vegetation, Fish, and Wildlife

Background

The littoral zone is important for many species of fish, supporting both juvenile and adult life stages. The littoral zone supports aquatic emergent and submergent plants that provide important food sources and nesting habitat for a wide variety of waterfowl, shorebird, mammal, and amphibian species. The fringe of riparian vegetation species that line the edge of the reservoir also provides crucial habitat for a wide variety of wildlife species.

The key to determining the magnitude and extent of impacts to the littoral zone is the time of year and the length of time the reservoir is drawn down, and the extent of drawdown that exposes the littoral zone to dessication. Therefore, the focus of this analysis centers on this narrow, but crucial zone of the reservoir. Weather patterns during the drawdown would influence the degree of impact. If the period from August 1 to September 10 is cool and rainy, substrates will not dry out as fast or as deeply as they would if this period were hot and dry. Also, the type of substrate determines how much soil moisture is held. Clay and organic matter dry out more slowly than sand and loam.

The Banks Lake littoral zone occurs in a band from 1569 feet to 1566 feet elevation. The number of days that the littoral zone would be exposed during drawdown is determined from the number of days the reservoir is at or below elevation 1566 feet. As shown in figure 4-1, the maximum amount of drawdown below the aquatic emergent vegetation zone that occurs under the No Action Alternative is 1 foot, while the length of time the aquatic emergent vegetation zone is exposed (dewatered) under the No Action Alternative ranges from approximately 11 days to 41 days. As shown in figure 4-2, the maximum amount of draft below the aquatic emergent vegetation zone under the Action Alternative is 6 feet, while the length of time the aquatic emergent vegetation zone is exposed ranges from approximately 20 days to approximately 41 days.

Vegetation

To determine how the proposed August drawdown would affect aquatic emergent vegetation and riparian vegetation in the littoral zone of Banks Lake, the distribution, abundance, and species composition of aquatic emergent vegetation and riparian vegetation were evaluated.

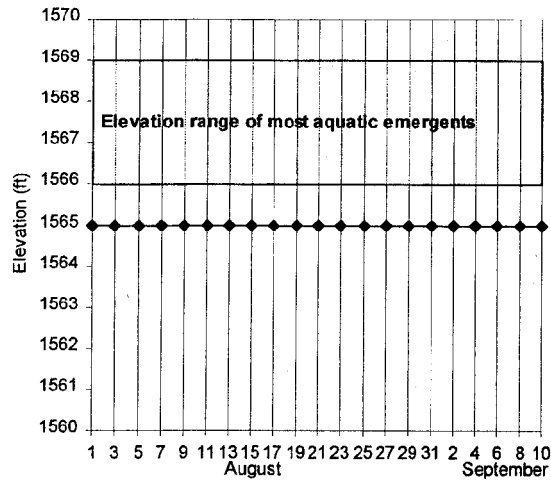
Drought tolerance of aquatic emergent vegetation species and the length of time that roots are exposed to drying conditions are factors used to determine the ability of plants to survive drawdowns. Another factor that affects plant survival is the weather during the drawdown. Hot, dry weather will dry out substrates faster than cool, wet weather. The growing season is nearing its end in August, therefore decreasing adverse impacts that might occur if drawdown occurred earlier in the growing season. The substrate type (soil composition) determines how fast groundwater will recede from soils in beds of aquatic emergent vegetation and, therefore, determines how fast the substrate will dry out during drawdown. Soils high in clay content or high in organic matter retain moisture longer through capillary action. Soils that are mostly sandy drain and dry out rapidly. The following types are based on Grant County and Douglas County soil surveys. Loam, very fine sandy loam, silt loam, sandy loam, fine sand, and loamy sand generally occur near the Million Dollar Mile North Boat Launch; west of the coulee wall in Section 2 of T25N/R28E and in Section 35 of T26N/R28E; on the south half of the Steamboat Rock State Park peninsula; at the Steamboat Rock Rest Area and Boat Launch; most of the Barker Flat area; and most of the upper reservoir area north of Kruks Bay. Soils with gravelly loam, stony loam, and cobbly loam generally occur in the south/southeast portion of the reservoir area near Dry Falls Dam. Soils subject to seasonal flooding, and poorly drained, very cobbly or consisting of rock outcrop are found predominantly in the Northrup Canyon, Steamboat Rock, Barker Cove, Old Devil's Lake, and Lovers Lane areas. Little site-specific data on soil composition exist for the Banks Lake littoral zone, increasing the uncertainty for any analysis of impacts.

There are two measures of impact: (1) the distribution, abundance, and species composition of aquatic emergent vegetation, and (2) the distribution, abundance, and species composition of riparian vegetation. The analysis is accomplished by examining the potential impacts to representative plant species that are combined to provide an overall impact assessment for each vegetative community.

No Action Alternative .—

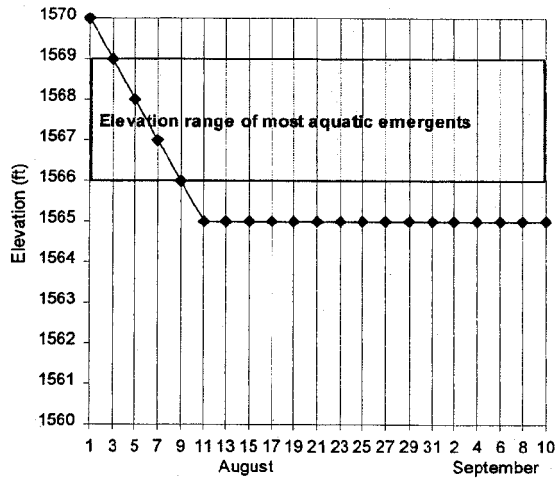
Distribution, Abundance and Species Composition of Aquatic Emergent Vegetation.—The well-developed stands of aquatic emergent vegetation would likely continue relatively unchanged. Reed canarygrass, an invasive exotic species, would continue to spread, although its rate of spread is difficult to predict. Eurasian water milfoil, also an invasive exotic, has spread

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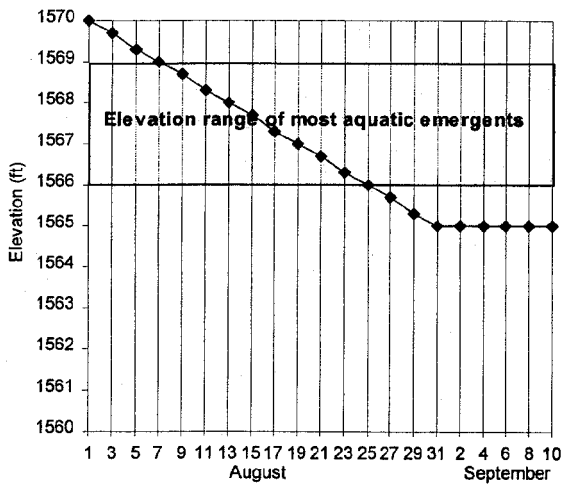
Approximate number of days aquatic
emergents exposed 1 ft = more than 41

No draft



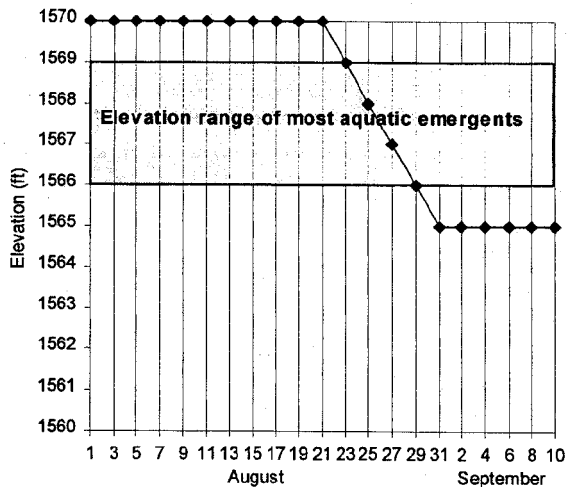
Approximate number of days aquatic
emergents exposed 1 ft = 31

Early draft



Approximate number of days aquatic
emergents exposed 1 ft = 14

Uniform draft



Approximate number of days aquatic
emergents exposed 1 ft = 11

Late draft

Figure 4-1.—No Action Alternative Scenarios.

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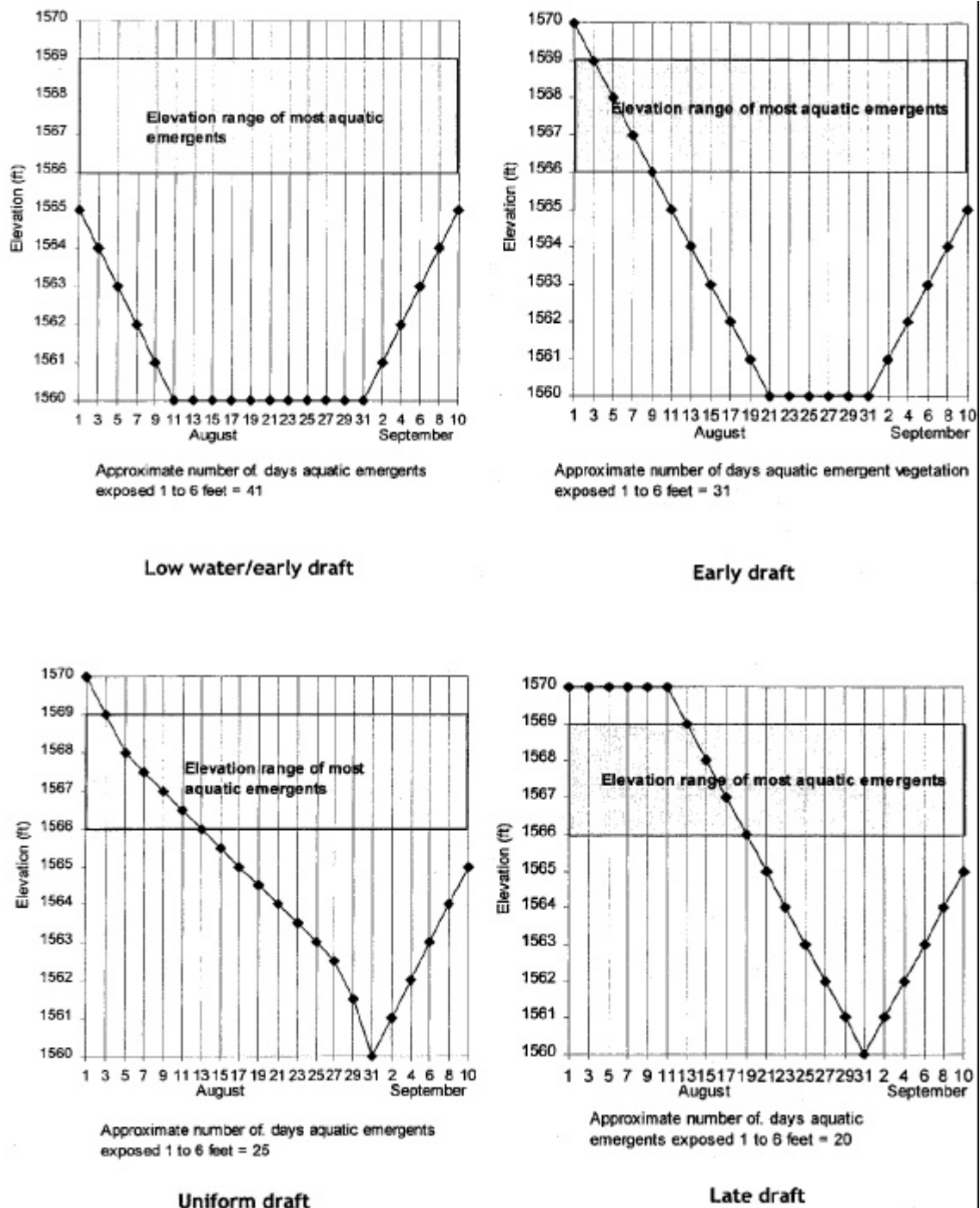


Figure 4-2.—Action Alternative Scenarios.

Distribution, Abundance and Species Composition of Riparian Vegetation.—The species composition and abundance of riparian vegetation species is likely to continue to exist in a similar manner for the 50-year life of the project.

Action Alternative.—

Distribution, Abundance and Species Composition of Aquatic Emergent Vegetation.— Depending on the scenario, the number of days the littoral zone is exposed ranges from approximately 20 days to 41 days. Drought-tolerant species, including Nebraska sedge, beaked sedge, hardstem bulrush, and baltic rush, would not be affected regardless of the soil composition. It is likely that hardier species such as common cattail, common spikerush, and baltic rush may outcompete less drought-tolerant species that become stressed and less vigorous. Common cattail often becomes dense in areas subject to regular drawdowns. The value of common cattail to waterfowl decreases if it becomes too dense.

A few drought-intolerant species such as softstem bulrush, American bulrush and redtop bentgrass may be affected and potentially reduced in extent, particularly if they occur in well-drained sandy soils. Two extremely valuable wildlife food species, Sago pondweed and duckweed, are obligate wetland species, and could be adversely affected by drawdowns. However, these two species are not currently widespread at Banks Lake. The invasive species, Eurasian water milfoil and reed canarygrass, would not be adversely affected.

Drawdown to elevation 1560 feet would not be expected to adversely impact the overall structure and function of aquatic emergent vegetation stands. The fundamental conditions that led to the development of stands of emergent vegetation would not be altered under the Action Alternative. Distribution of hardy species such as hardstem bulrush and common cattails that dominate the emergent vegetation communities would remain unchanged, while some of the more sensitive species may be reduced or eliminated. Table 4-1 provides a summary of impacts to several species of aquatic emergent vegetation that may occur in the study zone. No short- or long-term impact to the overall structure and function of Banks Lake aquatic emergent vegetation would occur under the Action Alternative.

Distribution, Abundance and Species Composition of Riparian Vegetation.—The present distribution and species composition of the thin strip of riparian vegetation above the high water line at elevation 1570 feet has developed and persisted under a water level regime that centers around fairly consistent elevations from 1568 feet to 1566 feet for most of the growing season. The species in table 4-1 represent some of the more common riparian plants present at Banks Lake.

Mature black cottonwoods, which provide perches for bald eagles and other raptors, have fallen victim to shoreline erosion. Fallen trees provide large woody debris used by many

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fish species for cover and as substrate by benthic invertebrates. Cattle grazing and other anthropogenic effects have reduced or eliminated seedlings. Shoreline erosion appears to be the most visible threat to this and other riparian species. The proposed drawdown to elevation 1560 feet would not accelerate the level of current wave erosion.

Groundwater levels recede both vertically and horizontally much more quickly in sandy and cobbly soils than in soils containing loam, clay, or organic material. A rough rule of thumb for the rate that groundwater recedes in the most well drained soils is 2.5 feet/month in vertical elevation and 10.4 feet/month in horizontal distance. At the other extreme, soils with high clay content can seal off at the surface and retain high soil moisture levels for extended periods of time. The clay and organic matter content of the soils beneath the riparian vegetation community at Banks Lake has not been characterized other than by the broad county soils maps. Therefore, some uncertainty exists regarding the response of riparian species to drawdowns. An additional source of uncertainty is the weather conditions that would be encountered in August and September during drawdowns. Therefore, a range of impacts is discussed.

In general, for mature established plants, soil moisture should remain adequate for all soil types, even for low-drought-tolerant species. However, seedlings of low-drought-tolerant species such as black cottonwood and peachleaf willow with shallow root systems may become stressed or eliminated if they have established on sandy well drained soils, particularly if August and early September are hot and dry. Other species have a range of drought tolerance from low to high, such as coyote willow and Wood's rose. Some individuals of these species may be reduced or stressed depending on the substrate.

Growth of riparian plant species is optimal when soils have abundant moisture. As drawdown occurs in the late summer portion of the growing season, minor impacts may occur to the growth rate and vigor of native riparian species. Russian olive is drought tolerant and rapidly colonizes riparian areas. As other low-drought-tolerant native riparian species are stressed and potentially reduced, it is possible that this exotic species could increase its distribution along the shoreline of Banks Lake. However, the Action Alternative would have no adverse impact to the overall structure and function of Banks Lake riparian vegetation.

Summary of Impacts.—Table 4-1 summarizes the impacts to several vegetative species in the Banks Lake littoral zone.

Table 4-1.—Summary of impacts to several vegetative species located in the Banks Lake littoral zone.

Species	No Action	Action Alternative
Reed canarygrass	Drought-tolerant, dominant stands in protected bays. Distribution and abundance increasing.	Distribution and abundance may decrease in sandy, cobbly areas where soil moisture decreases significantly, particularly if August and September are hot and dry.
Baltic rush	Drought-tolerant, dominant stands in protected bays. Distribution and abundance would remain stable.	No change
American bulrush	Obligate wetland emergent, subdominant stands in protected bays. Distribution and abundance continuous to be limited by availability of saturated habitats.	Moderately drought intolerant. Distribution and abundance may decrease in sandy, cobbly areas where soil moisture decreases significantly, particularly if August and September are hot and dry.
Nebraska sedge	Subdominant stands in protected bays and shorelines. Prefers saturated soils early in the season but later dry out.	Prefers early season saturated soils that dry out during the summer. Distribution and abundance likely to remain the same. No impact.
Common spikerush	Subdominant stands in protected bays and shorelines. Prefers saturated soils in early season.	No change
Common cattail	Subdominant stands in protected bays and shorelines. Generally restricted to areas where water depth never exceeds 2.6 feet.	No change
Redtop bentgrass	Drought-intolerant, facultative wetland emergent, subdominant stands. Drought intolerant.	May be reduced or eliminated in soil areas that dry out completely
Lesser duckweed	Obligate wetland species	Would likely be reduced regardless of soil composition.
Sago pondweed	Obligate wetland species	Would likely be reduced regardless of soil composition.
Eurasian water milfoil	Obligate wetland species	No change

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Table 4-1.—Summary of impacts to several vegetative species located in the Banks Lake littoral zone (continued).

Species	No Action	Action Alternative
Black cottonwood	Riparian species tolerates drought conditions when established.	Seedlings may be killed if established on sandy soils that dry out during drawdown, particularly if August and September are hot and dry. Seedlings in soils with loam and high organic content likely to survive.
Russian olive	Riparian exotic species, high drought tolerance.	No change
Peachleaf willow	Facultative wetland species located on transitional riparian sites	Low drought tolerance. May be reduced in areas that dry out, particularly if August and September hot and dry.
Coyote willow	Obligate wetland species that occurs in transitional riparian areas	May be reduced or stressed.
Red-osier dogwood	Facultative wetland species with medium drought tolerance	May decrease depending on weather and soil moisture.
Wood's rose	Riparian species with low to high drought tolerance	May be reduced or stressed.

Fish

One of the major concerns of the proposed action is the potential to reduce or eliminate spawning and nursery habitat for fish. Beds of aquatic emergent vegetation serve as critical spawning and nursery habitat for the majority of Banks Lake fish species. Other fish species spawn and rear in shallow unvegetated flats or in shallow areas over boulders, cobble, and gravel. Fish species that spawn in littoral areas can be adversely affected by water level fluctuations. Drawdowns can result in habitat loss and mortality to eggs and young after exposure or suffocation by eroded sediments (Hassler 1970). Drawdowns can also affect water temperatures, increase predation, and decrease food availability. Rapidly receding waters may also cause nest desertion, poor egg survival, and disrupted spawning for species such as largemouth bass, yellow perch, and common carp that spawn in shallow water. Low and variable spring water levels can adversely affect the spawning success of species such as yellow perch (Walburg 1976). Conversely, rising or high water levels during the spawning season and for several months afterward enhance postspawning survival by inundating shoreline vegetation that provides refugia and abundant food for young-of-year fish (Ploskey 1986).

Another concern is the exposure of juvenile fish to increased predation. Juveniles of many species move offshore during late summer and would not be affected by the dewatering of aquatic emergent vegetation or other littoral zone cover. Other species, however, rely on the cover of aquatic emergent vegetation year-round and would thus be affected. The degree of impact to fish populations would depend on the length of time water levels are drawn down.

Water level fluctuations can alter predator-prey relations by reducing habitat complexity and the overall amount of habitat available. Drawdowns may force small fish to abandon complex habitat in littoral areas serving as refugias, and increase their vulnerability to predation (Jenkins 1970). Piscivores such as walleye and trout, on the other hand, often increase in weight by feeding heavily on the concentrated prey. Water level drops will force juvenile and small fish out of the cover of aquatic emergent vegetation, as well as other cover such as logs, brush, boulders, and cobbles, increasing their susceptibility to predation. However, because the Action Alternative would occur for a maximum of 41 days, the impacts of the proposal would be minimized.

To determine the environmental consequences to fish habitat and fish populations, the following specific conditions were analyzed for the No Action and Action Alternatives.

- Quality and quantity of spawning and nursery habitat in shallow emergent vegetation; shallow unvegetated flats; and boulders, cobble, gravel.
- Ability of juvenile fish to withstand predation pressure during drawdown.
- Quality and quantity of aquatic food base.

No Action Alternative.—

Quality and Quantity of Spawning and Nursery Habitat.—The well-developed stands of aquatic emergent vegetation would continue to provide suitable spawning and nursery habitat for fish.

Susceptibility of Juvenile Fish to Predation.—Reservoir water levels would remain at or above elevation 1565 through August, keeping aquatic emergent vegetation available to juvenile fish for cover and protection from predation.

Quality and Quantity of Aquatic Food Base.—Stable water levels would allow continued production of benthic invertebrates.

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Action Alternative.—

Quantity and Quality of Spanning and Nursery Habitat.—

Shallow Emergent Vegetation.—As discussed previously in the vegetation section, the net result of drawdown to elevation 1560 feet would not be expected to adversely impact the overall structure and function of aquatic emergent vegetation stands. Drawdowns to elevation 1560 may temporarily force fish occupying the shallow emergent vegetation zone into open water; however, no long-term impact would occur to the overall quantity and distribution of emergent vegetation under the Action Alternative.

Shallow Unvegetated Flats.—The North Banks Lake and South Banks Lake maps (fig. 3-2 and 3-3) highlight the proposed 5-foot drawdown zone to elevation 1560 feet (light green). The wider the space between contour intervals, the lower the gradient. Extremely wide areas can be seen adjacent to Barker Flat, in the west and south shores of the Steamboat Rock State Park, along the Million Dollar Mile, as well as along the southwest portion of the lake in the game refuge. These are mostly unvegetated flats. The value of these areas lies primarily in the fact that they are shallow. The proposed 5-foot drawdown may force fish species into deeper habitats with potentially increased risk of predation. However, due to the gradients of the shoreline, shallow areas temporarily lost as a result of the drawdown would be replaced by a similar amount of new shallow habitat.

There are some areas that may become vulnerable to substrate erosion. This can be seen on the map as the zone where sharp dropoff occurs—shoreline areas out from the Million Dollar Mile South Boat ramp and Chase Draw to the south, as well as the south end of Steamboat Rock State Park. Erosion that occurs here may eliminate fine sediments, leaving more exposed boulders and cobble which will not erode. This may increase interstitial spaces for small fish cover.

Boulders, Cobble, Gravel.—This habitat type is typically found throughout much of the shoreline of Banks Lake, particularly in areas exposed to greater amounts of wind and wave action. It is unlikely that any erosion caused by declining water levels will change the composition of this substrate, except to remove some fine sediments.

Ability of Juvenile Fish to Withstand Predation During Drawdown.—The analysis of this measure is accomplished by examining the potential for increased predation for the fish species below and in table 4-2.

- *Ictaluridae.*—Juvenile channel catfish are not dependent on vegetation for cover but rely on turbid water to avoid predation. At elevation 1560 feet, shallow, turbid water would still be available along much of the western shoreline and in bays such as

Osborn, Kruk's, Jones, and Airport, as well as in the Devil's Punch Bowl and Barker Cove (see fig. 3-6). Therefore, increased predation on juvenile channel catfish would not result under the Action Alternative. Brown bullhead juveniles disperse to deeper water in the fall and should not experience elevated predation rates.

- *Centrarchidae*.—Juvenile largemouth bass cruise the shorelines as they mature but still require the cover of logs, brush and vegetation for protection from predation. Drawdowns may force juveniles out of the protective cover of emergent vegetation, increasing predation risk temporarily. Smallmouth bass juveniles are dispersed in deeper water in the fall and should experience little increase in predation.
- *Percidae*.—By late summer, juvenile walleye move toward the lake bottom in 10 to 30 feet of water. There will be little increase in predation as a result of drawdown. Yellow perch juveniles move into deeper water by mid to late summer but could be exposed to increased predation for 20 to 41 days.
- *Salmonidae*.—The young of mountain white fish move offshore in summer and should experience no increase in predation risk. Rainbow trout are stocked at a size large enough to avoid most predation.
- *Cyprinidae*.—Young common carp move into deeper water in late summer and would experience little increase in predation risk. However, young northern pikeminnows are found in shallow vegetation and would be exposed to increased predation.
- *Catostomidae*.—The young longnose suckers and bridgelip suckers remain in shallow weedy areas of lake shores and would likely be subjected to increased predation during drawdown.
- *Cottidae*.—Young prickly sculpin occupy shallow vegetation and would be subject to increased predation as water levels drop below the emergent vegetation zone.

In summary, largemouth bass, yellow perch, longnose sucker, bridgelip sucker, prickly sculpin, and northern pikeminnow have young-of-year present in aquatic emergent vegetation during August. These young-of-year may be forced out of the cover normally provided above the 1566-foot elevation. The amount of adverse impact on these species would depend on the length of time exposed to increased predation. The greatest impact would occur during the Low Water/Early Draft scenario resulting in 41 days of littoral zone exposure, during which time increased predation could occur. Predation pressure may be offset somewhat in species that have rapidly growing, fairly large young. Largemouth bass juveniles tend to be larger by late summer (2 to 5 inches) than other species. Their larger

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size may enable some to escape predators better than smaller individuals. Rainbow trout and kokanee are stocked at a larger size to avoid predation.

Walleye, smallmouth bass, adult largemouth bass, and other predators may experience an increased growth rate because of the increased food supply. Channel catfish, brown bullhead, smallmouth bass, walleye, yellow perch, mountain whitefish, and common carp all have young that are in deeper waters by August and, therefore, would not be influenced by cover availability in the littoral zone.

Although predation pressure may temporarily increase for some species during drawdown, the extent of the drawdown is relatively minor. Therefore, the Action Alternative would not result in an adverse impact on juvenile fish or fish populations.

Quantity and Quality of Aquatic Food Base.—Aquatic plants that support bacteria, zooplankton, benthic invertebrates, and fish can be affected directly and indirectly by water level fluctuations. Water level changes directly affect phytoplankton (single celled algae) by physical entrainment and removal in reservoir outflows (Benson and Cowell 1967) and indirectly affect nutrient concentrations, turbidity (which affects light levels), temperature, and grazing pressure (Jones and Bachmann, *Prediction...*, 1978; Jones and Bachmann, *Trophic...*, 1978).

Zooplankton.—Water level changes rarely affect zooplankton directly. However, as reservoir pool elevation dropped 10 feet, water temperatures would increase slightly. The overall abundance and diversity of zooplankton would not be impacted by the Action Alternative.

Benthic Invertebrates.—Minor impacts to benthic invertebrates would likely result from changes in water levels through exposure and mortality of species with poor mobility or without resting mechanisms. Mortality of exposed organisms reduces populations within the fluctuation zone. Indirect effects result from changes in habitat, food resources, or the chemical environment.

Limnological studies conducted in Hungry Horse and Libby Reservoirs described seasonal productivity of the food web in relation to drawdown (Independent Scientific Advisory Board 1997). Summer and fall growth periods for mountain whitefish, northern pikeminnow, large-scale suckers, longnose suckers, and yellow perch were driven mainly by abundance of zooplankton and benthic midges, although terrestrial insects were also of considerable importance. Availability of these forage sources were found to be influenced by seasonal temperature and drawdowns.

Adverse impacts to benthic invertebrates from drawdowns at other reservoirs has been well documented. It is likely that some adverse impacts to benthic invertebrates will occur

during the 5-foot August drawdown at Banks Lake. However, this is somewhat offset by the fact that the drawdown a relatively minor 5 feet as opposed to the large drawdowns of 30 feet or more experienced at reservoirs such as Hungry Horse and Libby. It is likely that the proposed drawdown will have only a slightly adverse impact on benthic invertebrates.

Aquatic emergent vegetation in shallow bays and protected shorelines that serve as critical spawning and/or nursery habitat for the majority of fish species in Banks Lake will remain intact. The Action Alternative is unlikely to cause declines in the overall production of fish species.

Summary of Impacts.—

Table 4-2.—Summary of impacts to fish habitats, species, and food.

Habitat/ Species/Food	No Action	Action Alternative
Shallow Aquatic Emergent Vegetation	Species include reed canary grass, American bullrush, cattail, and redtop.	Basic structure and function remain unchanged, providing spawning and nursery habitat for fish. Some drought-sensitive plant species may be replaced by drought-tolerant species.
Shallow Unvegetated Flats	Located south of the Million Dollar Mile Boat Ramp and east of Barker Flat.	Low gradient flats still available below elevation 1560 ft in most areas of the lake. Substrate in low gradient flats will not change due to erosion or sediment deposition. Some areas of steep gradients subject to increased erosion.
Boulders, Cobble, Gravel	Common substrates found predominately along steep western shoreline.	Drawdown may remove some fine sediments, but basic structure will remain unchanged.
Channel Catfish	Feeds in shallow water at night.	Young rely on shallow water for predator protection, but not on vegetation cover. Shallow water would still be available below 1560 ft in most areas.
Largemouth Bass	Continue to be limited to shallow areas with rooted vegetation or other natural cover.	Young cruise shoreline as mature but still require cover of logs, brush, aquatic emergent vegetation for predator protection. Will be exposed to increased predation 20 to 41 days. Relatively large size of young (2 to 5 in) may reduce predation risk somewhat.

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Habitat/ Species/Food	No Action	Action Alternative
Smallmouth Bass	Prefer rocky reefs and gravel bars	Susceptibility of juveniles to predation unchanged. Young dispersed in deeper water by August.
Walleye	Spawns in rubble, gravel, bedrock, and rocky shoals	Susceptibility of juveniles to predation unchanged. Young move toward lake bottom in 10-30 feet of water by late summer and would be unaffected by 5-ft drawdown.
Yellow Perch	Adaptable and able to use a wide variety of habitats	Young rely on dense aquatic emergent vegetation until late fall. Size of young can be as small as 1.8" in August. Preyed on heavily by predatory fish. Will be exposed to increased predation 20 to 41 days.
Rainbow Trout	Unable to establish reproducing population at Banks Lake	Trout stocked at larger sizes would avoid predation.
Kokanee	Reservoir population has declined significantly	Populations will continue to rely on stocking larger individuals.
Lake Whitefish	Spawns in rocky gravel or sandy substrates.	Susceptibility of juveniles to predation unchanged. Young move into deeper water by early summer.
Mountain Whitefish	Spawns in gravel shoals along shorelines.	Susceptibility of juveniles to predation unchanged. Young move offshore in summer.
Longnose Sucker	Adults occur along lake bottoms to 80 feet deep.	Young remain in weedy shallows and may be exposed to increased risk of predation.
Large-scale Sucker	Spawns on gravelly or sandy shoals and along shorelines.	Fry feed in vegetated shallows at night. May be exposed to increased predation.
Bridgelip Sucker	Seldom found in lakes, probably entrained into Banks Lake from Columbia River.	Young remain in weedy shallows. Exposed to increased risk of predation. Young somewhat larger than other suckers in summer (2.5 to 3.1 in), which may reduce predation somewhat.
Prickly Sculpin	Spawns in relatively shallow depths.	Young rely on shallows with aquatic emergent vegetation. Exposed to increased risk of predation 20 to 41+ days. Young sculpin are quite small (1.4 in) in summer.

Habitat/ Species/Food	No Action	Action Alternative
Northern Pikeminnow	Spawns along areas of shallow gravel beaches	Young in 3-ft deep water with vegetation in summer. Exposed to increase risk of predation 20 to 41+ days. Young relatively small in summer (1.8 in)
Common Carp	Adults occur in slow moving water with dense vegetation.	Young move to deeper water as mature.
Zooplankton	Species include <i>Bosmina</i> , <i>Cyclops</i> , <i>Nauplii</i> , <i>Daphnia</i> , and <i>Diaptomus</i> .	No substantial changes in water retention times. No change to zooplankton production.
Benthic Invertebrates	Species include midge, dragonfly, damselfly, and mayfly larvae.	Reduced production in area exposed, but remaining shallow habitat still productive.

Wildlife

To determine how the proposed August drawdown affects wildlife, the distribution, abundance and species composition of littoral zone wildlife species was analyzed. Analysis centers principally on the impacts of drawdowns on two habitats: aquatic emergent vegetation in shallow bays and protected shorelines, and the thin strip of riparian vegetation.

No Action Alternative.—The present distribution, abundance, and species composition of wildlife present in the littoral zone of Banks Lake is likely to remain unchanged from existing conditions.

Action Alternative.—

Raptors.—Most of the nesting substrate for raptors is along the adjacent cliffs, although some raptors may nest on mature cottonwoods and Russian olives along the shoreline. Raptors also use the mature trees as perch sites. It is unlikely that mature trees would be adversely affected either by increased erosion or by changes in groundwater during drawdowns.

Neotropical Migrant Songbirds.—Species such as red-winged blackbirds, yellow-headed blackbirds, and marsh wrens that nest in cattails would be unaffected by the Action Alternative, because aquatic emergent vegetation would remain largely intact. Other species that nest in riparian vegetation (such as willows, Russian olive, and cotton-woods) would

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not be affected, since little change, if any, would occur to mature trees.

Waterfowl.—Water levels would remain stable during the waterfowl nesting and brood-rearing season. Adequate emergent vegetation should remain available for cover and nesting. Temporary impacts to newly hatched young may result from minor loss of benthic invertebrates. It is anticipated that newly hatched young would still find shallows in which to forage.

Colonial Nesting Birds.—Under the Action Alternative, water levels would begin to decline after most chicks have been fledged. No land bridges that could provide access to nesting colonies by mammalian predators would be created.

Mammals.—The structure of aquatic emergent vegetation stands and riparian habitat would remain fundamentally unchanged. It is unlikely that mammals using either of these habitats would be adversely affected by the Action Alternative. However, highly aquatic species, such as the muskrat, may temporarily lose the cover of aquatic emergent vegetation during the drawdown period and may be at increased risk of predation. There should be no impact to muskrat or beaver dens that occur along the banks of the lake.

Amphibians and Reptiles.—Several amphibian species that potentially could inhabit Banks Lake use shoreline and upland habitats such as rotten logs, rocks, and low plant growth in the riparian area. Impacts are unlikely to occur to adults; however, the young of some species, such as salamanders, may be affected if they are unable to metamorphose to adults before the August drawdown begins. Highly aquatic species that rely on thick aquatic emergent vegetation, such as bullfrogs, would not be affected, since drawdowns are likely to cause common cattails to increase slightly. Habitat for reptiles is predominately in the adjacent uplands, as well as in the riparian vegetation. These habitats would not be affected by the Action Alternative.

The Action Alternative would not adversely impact the distribution, abundance, and species composition of wildlife in the study area.

Summary of Impacts.—A summary of impacts to wildlife is shown in table 4-3.

Table 4-3.—Summary of impacts to wildlife.

Measurement Distribution, abundance, and species composition of littoral zone wildlife.	No Action Alternatives	Action Alternatives
Raptors	Species include bald eagles, golden eagle, peregrine falcons, and cooper's hawk.	No change. No adverse impacts to perch trees or to food base. May have beneficial effects on bald eagle food base.
Neotropical Migrant Songbirds	66 species documented at Banks Lake	No change
Waterfowl	Dry Falls Dam, Devels Punch Bowl, and Osborn Bay provide important breeding grounds	No change
Colonial Nesting Birds	Species documented at Banks Lake include great blue heron, black-crowned night heron, California gull, ring-billed gull, and Caspian terns	Water levels drop after chicks fledged. No increased risk of predation or decreases in food base.
Mammals	47 species have been documented or could potentially occur at Banks Lake.	No adverse impact. Muskrats may be exposed to increased risk of predation.
Amphibians and Reptiles	11 species documented.	No change. Reservoir refilled before winter frost can kill any amphibians in mud substrate. Reptile habitat unaffected.

Threatened, Endangered and Special Status Species

No Action Alternative

Abundance and distribution of these species would continue to be limited by available habitat.

Action Alternative

National Marine Fisheries Service.—The Banks Lake drawdown would augment the flows in August, when flow objectives at McNary Dam are 200,000 cfs. This flow objective is intended to primarily benefit Snake River fall chinook salmon. The Snake River fall chinook juvenile migration tends to peak in mid-July with numbers tapering off into mid-August. Nearly half of the Snake River fall chinook can be transported from the Snake River collector dams and may not benefit from flow augmentation from the Columbia River.

There is some uncertainty surrounding flow augmentation benefits for fish survival. Snake River fall chinook is one species that appears to have a stronger flow survival relationship, although that survival relationship is also influenced by water temperature and turbidity (Giorgi, Miller, and Stevenson 2002; Bilby et al. 2002).

Fish and Wildlife Service.—The following analysis of impacts to federally listed threatened and endangered species is included in the draft EIS as part of Reclamation's Biological Assessment, required under section 7(a)(2) of the ESA. As discussed below, the proposed project would not affect the federally listed pygmy rabbit or the Ute ladies'-tresses. The bald eagle may be benefitted by the project due to potential increased fish availability. Due to the potential beneficial impact, Reclamation has determined that the bald eagle may be affected, but is not likely to be adversely affected by the action alternative.

Pygmy Rabbit.—The Action Alternative would not affect the adjacent sagebrush-steppe community at Banks Lake, either directly or indirectly and therefore would not affect the pygmy rabbit.

Bald Eagle.—Bald eagles could potentially benefit from increased concentrations of fish in shallow areas. Late summer drawdowns may force many fish species away from the cover of emergent vegetation and into the adjacent shallow water zones.

Mature cottonwoods and willows are unlikely to be reduced or eliminated as a result of the Action Alternative, nor is the risk of erosion expected to increase. Therefore, perch trees used by eagles would be unaffected.

Ute Ladies'-Tresses.—FWS (2002) indicates that the most suitable habitat present in the Banks Lake area exists at Bebe Springs and along two intermittent streams in the northwest side of Banks Lake. It is unlikely that these potentially suitable habitat areas would be affected by the Action Alternative.

Western Sage Grouse.—Sagebrush-steppe communities needed by sage grouse exist above the influence of the littoral zone at Banks Lake and would not be affected by the Action Alternative.

Washington Ground Squirrel.—Sagebrush-grassland habitat suitable for the Washington ground squirrel exists outside the influence of Banks Lake water levels.

Species of Concern.—The following are State proposed or listed species and/or State species of concern that may occur in the project area.

Table 4-4.—Summary of impacts to species of concern.

Species	Habitat	Action Alternative
Pale Townsend's Big-Eared Bat	Forages in uplands outside influence of Banks Lake.	No change.
Small-Footed Myotis	Forages around cliffs, dry canyons outside the influence of Banks Lake.	No change.
Yuma Myotis	Large roost documented in Northrup Creek.	No change.
Black Tern	No breeding records documented for Banks Lake. Potentially uses aquatic emergent vegetation during fall and spring migrations.	No change.
Columbia Sharp-tailed Grouse	Documented in Barker Canyon and potentially located in Northrup Canyon.	No change.
Loggerhead Shrike	Shrikes use shrub-steppe, pine-oak and pinon juniper woodlands.	No change.
Columbia Spotted Frog	Unlikely to be present in Banks Lake due to presence of abundant predatory fish. May be in adjacent wetlands.	No change. Water level in adjacent wetlands may decline after young have metamorphosed to adult stage.
Chelan Rockmat	Potential habitat along basalt cliffs. Outside littoral zone and influence of August drawdown.	No change. Potential habitat unaffected.

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Table 4-4.—Summary of impacts to species of concern.

Species	Habitat	Action Alternative
Sticky Phacelia	Potential habitat along basalt cliffs. Outside littoral zone and influence of August drawdowns.	No Change. Potential habitat unaffected.
Snake River Fall Chinook Salmon	Migrates through lower Snake and Columbia Rivers.	Potential beneficial change. Contributes to flow augmentation for juvenile migration.

Economics

Hydropower Resources

The Bonneville Power Administration has developed a Federal Columbia River Basin Power System model that they use to determine power impacts to the integrated FCRPS system resulting from changes in facility operations at the different participating projects. The changes in operation of Banks Lake and Grand Coulee Dam and the resulting impact to FCRPS hydropower generation under the proposed Action Alternative were evaluated by BPA. Reclamation estimated impacts to the three PUDs. GCPHA provided estimates of changes in power generation at the Main Canal Powerplant as a result of changes in head due to Banks Lake level fluctuations.

Power impacts are composed of two measures, the first being capacity values, the second being energy values. Capacity values are derived from the fixed costs of the hydropowerplants and include the fixed costs of the plant, fixed fuel inventory cost, fixed operation and maintenance (O&M) costs, administrative and general expenses, and transmission costs and losses to load center. Energy values are composed of the variable costs of the hydropowerplant and are made up of two components, variable O&M cost and variable fuel costs.

Impacts to Hydropower Generation.—Increases in power generation for all Grand Coulee powerplants and the resulting impacts to the FCRPS would occur mainly in the month of August, when Banks Lake would be drawn down to its lowest levels under the Action Alternative. There would also be an increase in generation from the hydropowerplants at Grand Coulee and the five PUD hydropowerplants, as more water

would be flowing downstream in the Columbia River to meet the endangered fish flow targets at McNary Dam instead of being pumped up to Banks Lake. However, increased pumping of water from Roosevelt Reservoir to refill Banks Lake would be necessary after August 31, requiring energy and reducing river flows, which would reduce the amount of energy the FCRPS and PUD hydropowerplants could produce. Less energy would be generated at the municipal Main Canal powerplant because of the head loss accompanying reduced lake elevations. This would also continue until Banks Lake refilled.

FCRPS Impacts.—Preliminary impacts to the FCRPS were provided by BPA and were discussed by level of drawdown for each alternative for comparison. Impacts were measured as a result of Banks Lake drawdown from 1570 to 1565 and 1565 to 1560 feet during the month of August and reported in MWh. Megawatt-hour impacts were then converted to real dollar values using replacement cost values estimated in BPA's 2002 *Final Power Rate Proposal Marginal Cost Analysis Study* (May 2000). The net energy⁴ impact resulting from refill of Banks Lake during the September time period was also estimated, as well as an estimate of the net annual revenue impact from the proposed Action Alternative. BPA anticipates that there will be no change in total FCRPS capacity⁵ as a result of the proposed alternative flow increases and reductions from Grand Coulee through Bonneville. Additionally, since the net energy loss over the August-through-September period is small, there is no significant effect on the FCRPS ability to meet future loads. Tables 4-5 and 4-6 display the FCRPS energy generation for each alternative.

Table 4-5.—FCRPS energy generation—No Action Alternative (Mwh).

No Action Alternative	No Draft	Early Draft	Uniform Draft	Late Draft
Power generated from Grand Coulee to Bonneville	0	85,000	85,000	85,000
Reduced pump load by not pumping to Banks	0	33,000	33,000	33,000
Total FCRPS energy generated from Banks Lake water	0	118,000	118,000	118,000

Source: BPA, FCRPS model

⁴Energy is the electric power provided by generators and measured in kilowatts over a period of time, usually hours, to yield kilowatt-hours (kWh).

⁵Capacity is the maximum load or demand that a generator or system can carry under existing service conditions.

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Table 4-6.—FCRPS energy generation—Action Alternative (Mwh).

Action Alternative	Low Water Early Draft	Early Draft	Uniform Draft	Late Draft
Increased power generated from Grand Coulee to Bonneville	85,000	170,000	170,000	170,000
Reduced pump load by not pumping to Banks	33,000	33,000	33,000	33,000
Pump load to refill Banks by September 11	(33,000)	(33,000)	(33,000)	33,000)
Loss in generation from Coulee to Bonneville due to refill of Banks	(93,000)	(93,000)	(93,000)	(93,000)
Total FCRPS energy impact	(8,000)	77,000	77,000	77,000

Source: BPA

No Action Alternative.—Under this alternative, Banks Lake surface levels could remain at 1565 feet during a low water year or be lowered from 1570 to 1565 feet in August during normal water years. During a low water year in which Banks Lake remained at elevation 1565 feet for the month of August, there would be no energy impact. Drafting from 1570 to 1565 feet would result in of 85,000 MWh of energy production to the FCRPS for the month of August due to higher Grand Coulee flows through Bonneville. Not pumping water from FDR Reservoir up into Banks Lake to replace irrigation demands for the month of August would reduce the FCRPS load by about 33,000 MWh.

Action Alternative.—

Low Water/Early Draft Scenario.—Estimated power generation for the Action Alternative scenario of low water/early draft scenario, which drafts Banks Lake from elevation 1565 feet to 1560 feet in the first 10 days of August results in net energy loss to the FCRPS of 8,000 MWh.

This scenario results in a negative change in energy generation. This negative change comes about because of three factors. The first factor is that less water is available for power generation through the Grand Coulee complex (127,200 acre-feet compared to 260,800 acre-feet under the other scenarios), the second is that the resulting refill of Banks Lake to the 1565-foot elevation requires additional pumping energy, and the third factor is that less water is available for power generation through the remaining FCRPS powerplants downstream of Grand Coulee.

Early, Uniform, and Late Draft Scenarios.—The early draft scenario likewise starts with Banks Lake at 1570 feet on August 1 and relies on the expected irrigation demands for the month to draft the lake down to 1560 feet. This would take 17-20 days, after which pumping would resume to maintain Banks Lake at elevation 1560 feet through the end of the month. The uniform draft scenario assumes that beginning August 1 the Banks Lake pool elevation is 1570 feet and is drafted evenly through August to elevation 1560 feet. The late draft scenario would start drafting Banks Lake from the 1570-foot elevation on August 11 reaching the final 1560-foot elevation on August 31.

These three scenarios would each result in 170,000 MWh of energy production to the FCRPS for the month of August due to higher flows from Grand Coulee through Bonneville. A reduction in pumping water from FDR Reservoir up into Banks Lake to replace irrigation demands for the month of August would reduce the FCRPS load by about 33,000 MWh.

Refilling Banks Lake from elevation 1560 to 1565 feet would require 93,000 MWh of energy due to the reduction of flows from Grand Coulee through Bonneville and add an additional load of 33,000 MWh to run the pumps.

Taking into account both the drawdown and the refilling of Banks Lake under the Action Alternative scenarios of early, uniform, and late draft, annual energy impacts to the FCRPS result in generation ranging from a loss of 8,000 to a gain of 77,000 MWh.

Net Energy Impacts to the FCRPS.—The following table displays the resulting net changes in FCRPS energy production as a result of comparing the No Action Alternative against the Action Alternative for Banks Lake operational changes. Net energy impacts range from losses of 8,000 kWh to 41,000 kWh to the FCRPS under each alternative.

Table 4-7.—Net FCRPS energy impacts from Banks Lake operational changes (MWh).

	Low Water Scenario*	Early Draft	Uniform Draft	Late Draft
No Action Alternative				
Total FCRPS energy generation	0	118,000	118,000	118,000
Action Alternative				
Total FCRPS energy generation	(8,000)	77,000	77,000	77,000
Total Net FCRPS energy impact	(8,000)	(41,000)	(41,000)	(41,000)
Total Net FCRPS energy replacement cost	\$293,200	\$1,502,650	\$1,502,650	\$1,502,650

* This is the No Draft scenario in the No Action Alternative and the Low Water/Early Draft scenario in the Action Alternative.

Source: BPA

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Main Canal Low Head Powerplant.—

No Action Alternative.—Under No Action, Banks Lake levels do not go below elevation 1565 feet, which represents the normal current historic range of lake operations. The GCPHA powerplant would continue to operate as it has historically, as shown in table 4-8.

Table 4-8.—GCPHA power generation—No Action Alternative.

	No Draft	Early Draft	Uniform Draft	Late Draft
Maximum Daily Capacity (MW)	20.5	23.1	23.1	23.1
Energy (MWh)	24,659	25,616	26,091	26,508

Source: GCPHA

Action Alternative.—The following table displays the change in capacity and energy generation at the GCPHA powerplant.

Table 4-9.—GCPHA power generation—Action Alternative.

	Low Water Early Draft	Early Draft	Uniform Draft	Late Draft
Maximum Daily Capacity (MW)	20.5	23.1	23.1	23.1
Energy (MWh)	23,246	24,202	25,154	25,987

Source: GCPHA

Table 4-10 displays the GCPHA power generation difference between No Action and the Action Alternative. A capacity cost of \$3,300 per MW and an energy replacement cost of \$36.65⁶ per MWh were used to arrive at the maximum estimated annual dollar losses for each alternative comparison. As a result of refilling Banks Lake to elevation 1565 feet by September 11 instead of by September 4 as originally modeled, an estimated maximum increase of 15 percent could be expected over what is displayed in the tables.

⁶Replacement power rate is the weighted average marginal cost of power (real \$/MWh) for the months of August and September determined in the 2002 *Final Power Rate Proposal Marginal Cost Analysis Study*, BPA, May 2002.

Table 4-10.—GCPHA power generation impacts.

	Low Water Early Draft	Early Draft	Uniform Draft	Late Draft
Capacity Difference (MW)	0	0	0	0
Capacity Loss	\$0	\$0	\$0	\$0
Energy Difference (MWh)	1,413	1,414	937	521
Energy Replacement Cost	\$51,786	\$51,823	\$34,341	\$19,095
Total Estimated Replacement Cost (Capacity & Energy)	\$51,786	\$51,823	\$34,341	\$19,095

Costs for kokanee entrainment net inspection and maintenance would be incurred by either alternative at a cost of \$8,000 to \$10,000 annually.

Public Utility District Hydropowerplants on the Columbia River.—Impacts were estimated to the five PUD hydropowerplants downstream of Chief Joseph Dam, between Chief Joseph and McNary Dams on the Columbia River. A comparison between the No Action and Action Alternative scenarios was made to arrive at the net change in energy production resulting from increased Columbia River flows during August and the subsequent reduced flows attributed to the Banks Lake refill period.

Each of the PUDs would need to replace the net energy generation lost as a result of operations under the Action Alternative in order to continue providing power to their customers. Using the same average energy replacement cost of \$36.65 per MWh (BPA 2000), the maximum estimated annual dollar losses for each alternative scenario comparison were determined. Table 4-11 displays the energy generation and replacement power cost impacts to Wells, Rocky Reach, Rock Island, Wanapum and Priest Rapids hydropower projects.

Resulting Impacts to Power Rates.—Although the pump/generators play an important role in load management for the FCRPS, they are a small part of a large system, made up of many facilities whose operations can be adjusted to compensate for this small overall change in a single facility's generation or use. Net revenue losses based on power replacement costs range between \$293,200 and \$1,502,700. Spreading these costs over the entire BPA rate base would result in negligible rate changes and would be insignificant. This is borne out in the significant changes in operations for the entire Columbia River power system, which were analyzed for the alternatives in the Columbia River System Operation Review final EIS.

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Table 4-11.—Energy impacts to PUD Powerplants on the Columbia River (MWh).

	Low Water Scenario*	Early Draft	Uniform Draft	Late Draft
No Action Alternative—Energy generation				
Wells	(8,083)	(202)	(98)	0
Rocky Reach	(10,507)	(420)	(203)	0
Rock Island	(4,850)	0	0	0
Wanapum	(9,699)	(2,425)	(2,425)	(2,425)
Priest Rapids	(8,891)	(3,734)	(3,734)	(3,734)
Action Alternative—Energy generation				
Wells	(8,275)	(357)	(191)	(70)
Rocky Reach	(10,908)	(742)	(397)	(147)
Rock Island	(4,850)	0	0	0
Wanapum	(12,008)	(4,733)	(4,733)	(4,733)
Priest Rapids	(12,446)	(7,290)	(7,290)	(7,290)
Total Net energy impact (MWh of replacement power needed)				
Wells	192	154	93	70
Rocky Reach	400	321	194	147
Rock Island	0	0	0	0
Wanapum	2,309	2,309	2,309	2,309
Priest Rapids	3,555	3,555	3,555	3,555
Total Net Energy Replacement Cost (\$)				
Wells	7,052	5,662	3,412	2,583
Rocky Reach	14,666	11,776	7,097	5,371
Rock Island	0	0	0	0
Wanapum	84,612	84,611	84,611	84,611
Priest Rapids	130,302	130,302	130,302	130,302

* This is the No Draft scenario in the No Action Alternative and the Low Water/Early Draft scenario in the Action Alternative.

Source: PN Region

Net average regional retail rate impacts were determined for all the alternatives and ranged from -1.1 percent to a high of 4.4 percent change, with the preferred alternative resulting in an estimated 2 percent change in rates. The projected rate changes were based on decreases in energy production greater than \$1 million.

Impacts to GCPHA as a result of decreased generation and increased expenses are small and could range from annual maximums of \$19,100 to \$86,900 including annual maintenance costs on the kokanee entrainment nets. These revenue losses would result in insignificant rate changes to GCPHA customers except in drought years, when market conditions could result in significantly higher replacement power rates.

Columbia River hydropower generation impacts to the three PUDs of Grant, Chelan, and Douglas counties range from an estimated \$2,580 to \$214,910 based on a replacement power cost of \$36.65 per MWh. These impacts would be considered to have an insignificant effect on customer power rates when spread over each county's rate base and its contracted customers.

As a result of hydropower generation impacts, it is not anticipated that there will be significant retail rate changes, either increases or decreases, to FCRPS, GCPHA, or the three counties' PUD customers as a result of drawing down Banks Lake during the month of August and its subsequent refill. Operation and maintenance costs to the power users and irrigators are also not anticipated to be affected by the proposed change in Banks Lake operations.

Regional/Local Economy

It follows that a change in operating procedures like those included in the Action Alternative could have a direct effect on some parts of the local and regional economic environment. Members of the planning team applied logic, experience, professional expertise, and professional judgment to analyze the impacts on the economic situation resulting from each possible scenario. Economic data, historic visitor use data, and expected future visitor use, were all considered in identifying and discussing expected impacts. A fourth factor, the length of time the reservoir would be at levels below 1565 feet, was also considered. This analysis and a qualitative analysis of the other factors are provided for the comparison of alternatives for decision making purposes.

The context, intensity, and duration of impacts were used to compare the Action Alternative to the No Action Alternative. Context refers to the relative area within which impacts occur; for the most part, impacts from the Action Alternatives will affect a regional area (Grant County) and/or a local area (e.g., a gateway community such as Coulee City).

Impact intensity is the degree to which a topic is positively or negatively affected. For this analysis, impacts on recreation were qualitatively evaluated and described. The following terms were used to describe the level of impact:

- Negligible – the impact is at the lower levels of detection.
- Minor – the impact is slight but detectable.
- Moderate – the impact is readily apparent.
- Major – the impact is severely adverse or exceptionally beneficial.

Impact duration refers to how long an impact would last. For this evaluation of impacts, the following definitions of duration were used:

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- Short term – the impact lasts less than three years.
- Long term – the impact lasts more than three years (and can be considered a permanent change in conditions).

The various permutations of the No Action never permit the lake level to go below 1,565 feet. This alternative represents the normal current range of lake operations—1,565 feet to 1,570 feet. Historically, the most likely operating range was between 1,567 feet and 1,569 feet. Operation within this range has no additional impacts on recreation at Banks Lake. (Infrequent, every 10 to 15 years, maintenance operations on the dam and other Reclamation facilities may require the lake be lowered to 1,545 feet. This low level would severely decrease the recreation opportunities available at the lake if this condition occurs during the summer recreation season.)

Recreation Days.—For the purposes of this analysis, it is assumed that recreational use of Banks Lake is not affected when the lake level is between 1,565 feet and 1,570 feet. Recreation opportunities could be negatively affected when the lake level falls below 1,565 feet. A first measure of this negative impact is the number of days that the lake is below this threshold during the month of August. Table 4-12 provides details of the impact analysis based upon the lake levels.

In any one-year the Action Alternative can follow a variety of scenarios depending upon the starting lake level and the procedure of the draft; the Low Water (1565 Feet) Early Draft and the Uniform Draft Scenarios bound the possible range of scenarios. For the purposes of this EIS, four scenarios have been selected for analysis. Each results in a lowering of the reservoir to elevation 1560 feet for some time in August. This refill period is the same for all possible action scenarios and is assumed to be 10 days, which represents the worse case situation.

- Low Water/Early Draft from 1565 feet: The water level of the reservoir begins to be lowered on August 1. This variation results in the reservoir being below 1565 feet for 41 days – August 1 through September 10. This scenario provides the lower boundary for the Action Alternative.
- Early Draft from 1570 feet: Under this scenario the lake level would not go below 1565 feet until August 11. The reservoir would be below 1565 feet for 31 days – August 11 through September 10.
- Uniform Draft from 1570 feet: This condition results in the reservoir falling below 1565 feet on August 16. The lake level would be below 1565 feet for 26 days – August 16 through September 10.

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- Late Draft from 1570 feet: This situation starts the drawdown on August 12. It is not until August 22 that the reservoir level falls below 1565 feet. The lake level would be below 1565 feet for 20 days – August 22 through September 10. This scenario provides the upper boundary for the Action Alternative.

Table 4-12.—Banks Lake Drawdown Study—impact analysis for recreation.

Alternative	Scenario	Elevation	Time Period	Results	Impacts on Recreation
No Action	No Draft	1565	Aug. 1-31	31 days at < 1570 ft 31 days at 1565 ft Zero days at <1565 ft	No impact
	Early Draft	1570-1565 1565	Aug. 1-10 Aug. 10-31	31 days at < 1570 ft 21 days at 1565 ft Zero days at <1565 ft	No impact
	Uniform Draft	1570-1565	Aug. 1-31	31 days at < 1570 ft 1 day at 1565 ft Zero days at <1565 ft	No impact
	Late Draft	1570-1565 1565	Aug. 1-21 Aug. 22-31	21 days at 1570 ft 10 days at < 1570 ft Zero days at <1565 ft	No impact
Refill of Banks Lake	There would be no refill of Banks Lake under No Action, since surface elevations will remain at 1565 feet on August 31.				
Action	Low Water Early Draft	1565-1560 1560	Aug. 1-10 Aug. 11-31	31 Days at < 1570 ft 31 days at < 1565 ft 21 days at 1560 ft	31 fewer Recreation Days Fewer recreation visits Lower \$ expenditures Indeterminate effect on net benefits
	Early Draft	1570-1565 1565-1560 1560	Aug. 1-10 Aug. 11-20 Aug. 20-31	31 days at < 1570 ft 21 days at < 1565 ft 11 days at 1560 ft	21 fewer Recreation Days Fewer recreation visits Lower \$ expenditures Indeterminate effect on net benefits
	Uniform Draft	1570-1565 1565-1560	Aug. 1-15 Aug. 16-31	31 days at < 1570 ft 16 days at < 1565 ft 1 day at 1560 ft	16 fewer Recreation Days Fewer recreation visits Lower \$ expenditures Indeterminate effect on net benefits
	Late Draft	1570 1570-1565 1565-1560	Aug. 1-11 Aug. 12-21 Aug. 22-31	11 days at 1570 ft 20 days at < 1570 ft 10 days at < 1565 ft 1 day at 1560 ft	10 fewer Recreation Days Fewer recreation visits Lower \$ expenditures Indeterminate effect on net benefits

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					benefits
Alternative	Scenario	Elevation	Time Period	Results	Impacts on Recreation
Refill of Banks Lake		1560-1565	Sep. 1-10 The refill time is the same for all scenarios.	10 days at < 1565 ft	10 additional fewer Recreation Days for all Action Alternative scenarios.

Recreation Visits.—Historically, lower recreational use at Coulee City Community Park, Steamboat Rock State Park, and Sunbanks Resort were recorded when water levels went lower than 1565 feet. This could result in fewer recreation visits occurring on Banks Lake.

Expenditures.—The economic impacts on Grant County and local businesses are of concern to local interests. Specifically, reduced water access could decrease the recreation opportunities at the lake, thereby resulting in fewer visitors to the commercial enterprises. The lost income for some enterprises can negatively affect their financial viability. Representatives of Coulee City Community Park, Steamboat Rock State Park, and Sunbanks Resort have all expressed concern regarding the impact that lower lake levels may have on their businesses.

Expenditures.—The economic impacts on Grant County and local businesses are of concern to local interests. Specifically, reduced water access could decrease the recreation opportunities at the lake, thereby resulting in fewer visitors to the commercial enterprises. The lost income for some enterprises can negatively affect their financial viability. Representatives of Coulee City Community Park, Steamboat Rock State Park, and Sunbanks Resort have all expressed concern regarding the impact that lower lake levels may have on their businesses.

However, the overall economic impact on the Grant County economy is expected to be negligible. In 1999, Grant County's economy provided over 38,000 jobs and more than \$900 million in earnings to workers. Any decline in business for recreation enterprises would have little affect on these elements of the economy. In addition, recreational businesses are highly seasonal in nature. This fact makes individual firms more susceptible to negative shocks during the summer season but also ameliorates the impact such occurrences have on the county's overall economy.

Net Benefits.—The net benefits (value or consumer surplus) of recreation opportunities at Banks Lake would be expected to decline because of the reduction in visitor use. However, there are many close substitutes for recreation on Banks Lake. The vast Lake Roosevelt (Coulee Dam National Recreation Area) lies a short distance northeast of Grant County. A number of lakes and reservoirs offering public recreation opportunities similar to those

found at Banks Lake are also found in Grant County; Sun Lakes, Billy Clapp Lake, and Moses Lake to name three with State Parks on their shores. It is expected that some visitors displaced by the lower water levels at Banks Lake would take advantage of recreational opportunities at these other lakes. If so then some of the net benefits that would disappear at Banks Lake would reappear at these other reservoirs. The degree to which losses at Banks Lake are gains at other lakes is unknown; thus, the Action Alternative would have an indeterminate effect on net benefits for recreation.

Any adverse impacts resulting from the Action Alternative would be focused within Grant County in general and specifically on a few recreational enterprises located on Banks Lake. Because of the size of the Grant County economy the economic effects would be negligible at the county level. However, some individual enterprises may be negatively affected from a moderate to major degree. The change of water levels on Banks Lake is a long-term change in the operation of the reservoir. Some of the impacts on local business may be either short- or long-term depending upon the degree to which local enterprises can accommodate and adapt to the August-September changes in water level.

Recreation

No Action Alternative

Historically, elevation changes to Banks Lake have an effect on the availability of recreational resources surrounding the lake. Under the No Action Alternative, there are no additional effects on the current recreational opportunities at Banks Lake. Banks Lake is recognized locally and regionally for its diverse and outstanding recreational opportunities. These opportunities exist throughout the area for camping, swimming, boating, picnicking, and other recreational pursuits under the No Action Alternative.

Public use varies seasonally, with peak activity and visitation occurring from mid-May through September. Both local residents and people who generally travel 100 to 200 miles use the area. Most out-of-area users are from the Puget Sound (Seattle/Tacoma) area, who are looking for uncrowded recreational opportunities, sunny days, and warm water. Over the Labor Day weekend, most camping and recreational facilities are at full capacity.

Action Alternative

The Action Alternative may have various impacts to the recreational opportunities at Banks Lake. Of the 19 developed recreational areas, 12 maintain usable boat launches. Anecdotal evidence, developed during the project's scoping process, suggests that drawing the lake

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down lower than elevation 1565 feet would negatively affect some recreational facilities and operations on the lake. For example, the following boat launches are left out of the water and thus rendered unusable at elevations lower than 1565: Steamboat Rock State Park, Sunbanks Resort, and Coulee City Community Park (see fig. 3-2 and 3-3). Coulee City Community Park has the only accessible boat launch for the southern half of the lake at elevation 1565. A 10-foot drawdown to 1560 would leave only two boat launches for use: Steamboat Rock Rest Area and Coulee Playland. These two boat launches are located on the northern portion of the Lake. No boat launch would remain for the southern half of the lake.

Reclamation does not directly manage any of the recreational sites at Banks Lake. The WDFW is currently responsible for the operation and maintenance of six boat launch sites, and the SPRC is responsible for three boat launch sites at Banks Lake. Operation and maintenance responsibilities for the other boat launches located on the reservoir (Coulee Playland, and Coulee City Community Park) are the responsibility of the respective lessee or concessionaire. Sun Banks Resort is located on non-Federal land and is administered by the WDNR. Therefore, Reclamation is not obligated to provide mitigation for this recreation site.

At lower lake levels, sandy beach areas may be far from the water's edge with unattractive and unappealing mud flats being exposed. This will discourage swimming and other beach activities. These changes to the recreational opportunities may have adverse effects and lead to decreased visitor use at the recreation areas on the lake.

The Washington State Department of Transportation is concerned that lower water levels may affect the stability of the road bed where State Highway 155 directly abuts the lake. Wave action on the lower portion of the subgrade may erode the roadway foundation. In addition, the underground/underwater power line that serves the recreation area at Steamboat Rock State Park will be exposed near the Steamboat Rest Area and Boat Launch.

As previously stated, the primary facilities that could be affected by lowering the lake would be boat launches, mooring docks, and swimming beaches at the various water access sites. In addition, the channels used to proceed from the boat launching areas (i.e., at Coulee City Community Park, Steamboat Rock State Park, and Sun Banks Resort) to the main body of the reservoir may become too low to allow the passage of watercraft. During reservoir drawdowns, rocks and sandbars are sometimes exposed or lie just below the surface. Launching is reported to increase at the Steamboat Rock Rest Area and Boat Launch during low reservoir elevation periods (Steinmetz 1998).

Recreation Visits.—The recreational opportunities that are available at Banks Lake can be reduced because of several factors. A degree of difficulty regarding watercraft access may be

present at water elevations below 1565 feet. A minimum water elevation of 3 feet above that toe of a boat ramp is usually necessary for launching a medium sized boat. Only two boat launches would be available at the 1560-foot elevation, Coulee Playland and the Steamboat Rock Rest Area and Boat Launch. Watercraft could access the lake; however, it would be limited, and usage would increase at those sites.

Dock and mooring areas may also be rendered unusable by lower water levels. Most docks on the lake are floatable to accommodate some variation in lake levels and still be usable. However, since the lake elevation rarely has gone lower than 1565 feet, docks and mooring areas may be unusable at this level without additional modifications. Accessibility requirements would also have to be addressed.

Water channels may be too shallow to allow access to the main body of the lake. Coulee City Community Park, the channel between Devil's Punch Bowl and the main body of the lake, and Sun Banks Resort have been identified as places where water levels below 1565 feet impede watercraft access to the main body of the reservoir.

Swimming is a popular activity at Banks Lake. Low water levels may negatively affect the four developed swimming areas on the reservoir. Beach areas may be left high and dry at water levels below 1565 feet.

Mitigation

Extending boat launches, modifying mooring docks, and dredging deeper channels would improve watercraft access at lower water levels. To the extent available, funds will be provided to ensure that usable boat ramps, courtesy docks, and swimming areas still exist on both the north and south ends of Banks Lake. Not all such areas need to be enhanced, but public access will be maintained to the lake for recreational purposes.

Irrigated Agriculture

No Action Alternative

Reclamation's ability to provide full Banks Lake irrigation operations would not be affected.

Action Alternative

The Action Alternative would not impact Reclamation's ability to provide full Banks Lake irrigation operations.

Historic Resources

No Action Alternative

Impacts to historic resources from this alternative are not known, but if impacts occur, they are assumed to be related to water fluctuation and waves on the shore. Secondary impacts may occur from alternating wetting and drying of soil, and wind erosion of exposed sediments. These impacts have not been researched at Banks Lake. Surveys to identify historic resources in the 1565- to 1570-foot normal drawdown zone would occur in late summer 2002. Once an inventory of resources is completed, impacts from the normal annual drawdown, if any, will be assessed upon discovery and recording.

Action Alternative

Like the No Action Alternative, impacts to historic resources from this alternative, if any, are presumed to be linked to water fluctuations, wave action, alternating wetting and drying of the soil, and wind disturbances. To address this possibility, surveys to identify historic resources in the 1560- to 1565-foot drawdown zone would occur to identify sites and to assess potential impacts.

Mitigation

No historic resources are known to exist under either alternative, because inventories for them have not occurred yet. Both alternatives present Reclamation with the opportunity to conduct historic resource surveys and to follow the Section 106 process to evaluate the historic resources identified, evaluate the potential impacts to significant sites, and develop measures to mitigate the impacts, if any.

Traditional Cultural Properties

No Action Alternative

Effects on traditional cultural properties, if any, from normal reservoir operations are not understood. A survey will be done during the 2002 drawdown, and impacts from the annual 1565- to 1570-foot drawdown will be assessed.

Action Alternative

Like the No Action Alternative, effects on TCPs from a drawdown from 1565 to 1560 feet are not understood. If this alternative is implemented, a survey will be done to identify TCPs, and the impacts will be assessed.

Mitigation

No TCPs are known to exist under either alternative, because the inventories to identify them have not occurred yet. Both alternatives present Reclamation with the opportunity to conduct the necessary research and to follow the Section 106 process to evaluate them.

Indian Trust Assets

No Action Alternative

Existing trends for Indian Trust Assets would continue under the No Action Alternative.

Action Alternative

There would be no impacts to ITAs in the drawdown zone between surface elevations 1565 feet and 1560 feet.

Environmental Justice

The Council on Environmental Quality's *Environmental Justice Guidance under the National Environmental Policy Act* (1997) states race, ethnicity and income should be examined. Data from the U.S. Census Bureau (1990 and 2000) were used to determine the minority population in the Banks Lake area. As income data from Census 2000 were not available, U.S. Census Bureau County Estimates for People of All Ages in Poverty for Washington: 1998 were used as a proxy for low-income.

CEQ guidance states minority population should be identified where either the minority population of the affected area exceeds fifty percent or the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population.

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Professional expertise and judgment were used to review impacts of implementing the Action Alternative to determine whether minority or low-income populations would be disproportionately adversely affected.

Although the minority population of Grant County is less than 50 percent of the total population, as discussed in the Economics section, the loss of income for some businesses dependent on recreation at Banks Lake can negatively affect their financial viability. However, racial and ethnic employment data are not available for individual businesses, thus disproportionately adverse impacts cannot be determined for them. Minority agricultural workers would not be affected as no impacts to agriculture were identified. Power rates are not anticipated to change as a result of this action, thus minority and low-income populations would not be disproportionately adversely affected.

No Action Alternative

No change from existing conditions is anticipated.

Action Alternative

No adverse environmental justice impacts were identified.

Surface Water Quality

The following indicators have been used for the water quality evaluation:

- Lake changes in temperature profiles, stratification and other water quality parameters.
- Groundwater changes in concentration and water levels.

No Action Alternative

Four different drawdown scenarios have been developed to show the range of conditions that may occur as the Lake is operated from 1570- to 1565-feet of elevation. The No Draft Scenario begins at 1565 feet at the beginning of the month and remains at that elevation. The Early Draft is a linear draft starting at 1570 feet on August 1, reaching elevation 1565 feet at August 10. The Uniform Draft is a linear draft throughout August starting at 1570 feet and going to elevation 1565 feet at the end of the month. The Late Draft remains at elevation 1570 feet until the 21st of August, then drafts linearly to the end of the month to elevation 1565 feet.

These scenarios would have small differences of water quality between them; timing of the events from each of the scenarios will cause minor differences between them also.

Although lowering of the surface elevations may result in slumping, the scenarios that stay at one elevation will have more shoreline erosion than if the erosive processes occur over a range of elevations. Shoreline erosion would be the greatest for the No Draft Scenario when the lake elevation will be at 1565 feet during most of the month. Surface runoff will wash sediment exposed above 1565 into the water. This process will increase the turbidity along the shore of the lake and over time will create an armored section of coarse pebbles or rock in some areas.

The Early Draft Scenario would tend to wash sediment down to elevation 1565 and would erode the sediment at 1565. This will create turbidity along the shoreline where fine sediments exist. The water temperature in these areas would increase temporarily in the shallow waters but would return to normal conditions as the water turbidity reduced.

The Uniform Draft Scenario would distribute the erosive action from 1570 to 1565 feet of elevation. This may move the sediment into the reservoir quickly as the soils would be wetted and subject to erosion as the water receded between these elevations. However, the erosion would be much the same as occurs with current operations. Changing one months operation will not change the water quality in any significant way for the year's operation. Sediment would be redeposited to lower elevations as the reservoir was operated at a higher elevation later in the year.

The Late Draft Scenario would be at full elevation during the first 20 days of August and would have little change because the erosion at full pool has already stabilized. Some additional erosion would occur during the beginning of September where fine sediment has been deposited.

Thermal changes occur in the lake as the lake surface is lowered. As the water elevation is decreased the temperature profile remains constant from the surface to the bottom as water is taken from the bottom for irrigation. The temperature profile of the reservoir will appear much as if the lower 5 feet of the profile was cut off the bottom of the reservoir when the reservoir surface is lowered 5 feet. There will be little change in the water released because of the nearly constant temperature in the bottom of the reservoir. Because the profile does not change the physical and biological processes will not change in the reservoir. Both the No Action and Action alternative will change as described above. However the Action alternative may increase mixing more as the reservoir is refilled and this may cause the nearly uniform temperature to occur earlier in the year. This shift will likely be from 1 to 2 weeks at most. Growth of zooplankton and other biological activities may be decreased as compared to the No Action Alternative.

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Anecdotal reports from fishermen indicate warmer temperature profiles have been observed at lower reservoir elevations. This may be the result of having large areas with shallow water accumulating more heat than at higher elevations plus the volume of water is slightly smaller at a lower elevation. Both factors would increase the water temperature slightly as the shallow warmer water is mixed in the lake. Consequently, the No Draft Scenario, maintained at elevation 1565, would result in the greatest increase in lake temperature. The Early Draft scenario would have the next greatest temperature increase, followed by the Late Draft scenario and then by the Uniform Draft Scenario, which would have the smallest lake temperature increase. The amount of temperature increase would probably be small and would likely be within the range of temperature variations experienced in the past from year-to-year variability of meteorological conditions.

Dissolved gasses would change very slightly because the ability of water to keep dissolved gas is inversely proportional to the temperature of the water. This means that dissolved gas concentration would be less as the water temperatures increased. The amount of decrease would be small, almost immeasurable between the various scenarios. However, the mainstream of the Columbia River has been experiencing super-saturated dissolved gas problems and the water pumped into Bank's Lake will have higher dissolved gas concentrations. This increase will be more than the decrease due to water temperature increases. No reports of gas bubble disease have been observed in Bank's Lake at his time.

Action Alternative

The Action Alternative scenarios consider that the lake level would be dropped to elevation 1560 in August. Small changes in temperature profiles and stratification may occur as a result of no pumping from FDR Lake into Banks Lake. Also the processes that increase the warming will increase as the lake is drawn to a lower elevation. As indicated in the No Action section, nearly the same amount of heat would be entering the surface of the lake and the volume of water may be less at lower elevations and the surface layers of the lake will become warmer as a result. The stratification would become more defined and the surface to bottom temperature difference would increase slightly. The scenarios within the Action Alternative will be discussed in order of least change to greatest change from No Action.

The Low Water Early Draft Scenario starts at elevation 1565 feet and drops linearly with time to elevation 1560 feet at the middle of the month and stays at the lower elevation longer increasing lake temperatures. The lake would be warmer at the lower elevation of 1565 feet as has been observed historically. The volume from drawdown would be about the same as irrigation needs from August 1 until the middle of the month. Mixing would result in less storing of solar energy in the top layers of the reservoir. After the middle of the month pumping will be needed to maintain elevation 1560 feet. Increased mixing will

occur at the first of September and the stored solar energy, in the form of higher temperatures in the upper layer will combine with a constant solar heat input to a lower reservoir volume to heat the lake more than any of the scenarios.

For the Early Draft, the water surface would change from elevation 1570 feet to elevation 1560 feet from August 1st to the 21st remain at 1560 until the end of August then pumping would occur until elevation 1565 was reached. Temperature profiles would be very similar to the No Action early drawdown. With this scenario, the irrigation demand would be supplied by drawdown until August 21st then pumping would be needed to meet irrigation demand until the end of the month. Then increased pumping would fill the Lake to elevation 1565 feet. More pumping than for the Late or Uniform Drafts would occur. Mixing the stored solar energy in the lake and increasing the temperature while the lake was at elevation 1560 feet. Nearly constant solar heating of a smaller reservoir volume would further increase water temperatures.

The Uniform Draft Scenario starts at elevation 1570 feet and decreases linearly to elevation 1560 feet by the end of the month, then pumping starts to reach elevation 1565 feet by the 10th of September. The rate of drawdown is very close to the irrigation demand during August so no additional pumping will be required from FDR Lake. The pumping will tend to cause more mixing in September and will tend to warm the reservoir to a greater depth than for the Late Draft Scenario. A greater amount of heat would be heat gained than for the Late Draft Scenario, because nearly the same amount of heat as at full pool will be mixed in a smaller volume of the reservoir over the month of August. As a result Banks Lake would increase in temperature more than it would for the Late Draft Scenario.

The Late Draft scenario, would draw Banks Lake down linearly, beginning the 10th of August and continuing to the end of the month. Pumping would be needed during the month to meet the irrigation needs and the pumped cooler water from FDR Lake would be most similar to the No Action conditions. Pumping would start in September and would cool Bank's Lake temperatures. Also heating of the lake would be less than any of the action scenarios because of nearly constant heat transfer into a larger volume of water will minimize the temperature change from No Action.

As mentioned in the No Action section dissolved gas concentration would be decreased as temperatures increased. Each of the action scenarios would have less dissolved gas than the No Action Alternative because they all have higher temperatures in the lake than the No Action scenarios. The amount of the decrease is likely to be small and probably within the error limits of repeatability of dissolved gas measurements. So it would be difficult if not impossible to measure differences in dissolved gas concentrations between Action and No Action Alternatives. The effects of supersaturated dissolved gas being pumped into Banks Lake would be more than the changes from temperature. Dissolved gas changes would be similar to the No Action Alternative for all of the Action Alternative scenarios.

Groundwater Quality

No Action Alternative

No change to existing groundwater conditions would occur under No Action.

Action Alternative

Effects on groundwater quality would be small, if any, due to the short period of time that the water level of Banks Lake is drawn down and the change of water surface is only 0 to 5 feet. Some local fissures and cracks in the surface rocks could respond to the changes in lake elevation but would be localized to the immediate vicinity of the lake/soil interface, not effecting the groundwater levels or concentration. Groundwater movement through soils is very slow and the aquifer would barely start to respond to changes in recharge elevation before the reservoir would be raised back to about 1565 feet near the first part of September. These small changes in recharge rates as a result of the Action Alternative would likely have no measurable change in the groundwater quality.

Native American Sacred Sites

A discussion of Native American Sacred Sites seeks to disclose whether or not access to sites deemed “sacred” in accordance with Executive Order 13007 will be impacted by a proposed action. There are two ways to learn if sacred sites are present, either of which can be inconclusive for reasons unique to the Tribe(s) involved: (1) asking the Tribes directly, or (2) from inference based on related resource surveys, such as surveys for historic resources, traditional cultural properties, or other natural resources, such as plants or geological investigations. Both of these methods apply to the current action.

Current knowledge on the locations and kinds of sacred sites in the drawdown zones is incomplete, primarily because Tribal cultures have their own reasons for not sharing the information. Probably because Steamboat Rock is such a prominent landscape feature, and figures into the mythology of both the Colville and Yakama Tribes, they have been willing to inform the public that Steamboat Rock is important culturally (Carmack 2001; Consortium of Johnson O'Malley Committees of Region IV 1974: 203) and may represent sacred sites, subject to Executive Order 13007.

No Action Alternative

Access to Steamboat Rock will be the same as currently exists.

Action Alternative

Access to Steamboat Rock will not be affected.

Mitigation

Because no known sacred sites would be adversely affected, no mitigation measures are proposed. Although there is no requirement to mitigate for loss of access to sacred sites, neither alternative intends to affect access.

Visual Quality

No Action Alternative

The visual quality of the Banks Lake area will not be affected.

Action Alternative

The visual quality of the Banks Lake drawdown will have a minimal effect because of the 5 foot strip of bare land during the drawdown period.

Air Quality

There will be no change in air quality in either the No Action or the Action Alternative.

Soils

No Action Alternative

All drawdown scenarios will be gradual enough (less than 2 feet per day) to not affect the soils in the study area. Impacts would be limited to erosion from exposed soils left between elevation 1570 and the water surface or from wave and ice impacts at the water surface. According to the refill configuration used that elevation may be anywhere between elevation 1570 and 1565. Such activities in previously undisturbed areas would cause mechanical disturbance to the soil surface and destruction of the protective vegetative cover including vascular plants and soil stabilizing microbiotic soil crusts. These disturbances often lead to soil aggregate destruction and channel formation. Destruction of vegetation and disturbance of spawning beds caused by erosion will continue regardless of the surface elevation of the lake but the zone of erosion will take place at the surface elevation. If the surface elevation is retained at or close to elevation 1565 during the fall and winter of the year the heaviest erosion will take place down slope from the shoreline of the full pool. This will allow redeposition of soils during the spring and summer to fill erosional areas developed during the time of drawdown and help to maintain the current high water shoreline. This will maintain a more stable lake bottom from elevation 1565 to elevation 1570.

The most severe soil resource effects are expected to continue on those portions of the shoreline located south of the Million Dollar Mile North Boat Launch, on the south half of the Steamboat Rock peninsula, at Barker Flat, at Kruk's Bay/Airport Bay, and in the upper (north) portion of Banks Lake.

Action Alternative

All scenarios of drawdown in the Action Alternative are less than the maximum of 2 feet per day that it is believed would cause failures in the shoreline of Banks Lake. As all scenarios also refill the reservoir to elevation 1565 within the first 10 days of September there will be no effects on soils that are different than the No Action Alternative.

Social Environment

No Action Alternative

For some, as operation of Banks Lake will not change, values will not be affected. For others who value increased water for endangered salmon runs, their values will not be upheld.

Action Alternative

Impacts to recreation, the local economy, power production and power rates are discussed in the Economics section. While recreation opportunities may minimally decline at Banks Lake during the period of drawdown, other opportunities for water-based recreation are nearby. Recreating individuals with strong emotional ties to Banks Lake will be most adversely affected. Overall impacts to the Grant County economy are expected to be negligible. While lost income for some businesses can negatively affect their financial viability, the degree of impact will depend in part upon their ability to adapt their facilities to the lower lake levels in August. Those who are not able to adjust to a loss of income or are unable to adapt their facilities will be most adversely affected. Power production and power rates should not be significantly adversely affected.

The social values of those who desire increased water for endangered salmon runs will be upheld.

Cumulative Impacts

Cumulative impacts are impacts on the environment that result from the incremental consequences of a proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of who undertakes these actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Those projects described in Chapter 1 under *Other Related Actions and Activities* may add to cumulative impacts to these resources.

Emergent/Riparian Vegetation

Change in the water level at Banks Lake due to lowering of the reservoir during the month of August to support flow in the Columbia River for anadromous fish will have a minor impact on a variety of species and abundance in the emergent and riparian areas around the reservoir. As identified in the discussions elsewhere in this document about vegetation, it is expected that the duration of drawdown will not extend beyond 40 days, and most vegetation around the reservoir is capable of withstanding that much dehydration due to lower reservoir levels.

Implementation of the Banks Lake RMP (Reclamation 2001) is expected to enhance shoreline vegetation. The RMP includes several actions, such as the closure of several roads that currently impact the shoreline, reduction of indiscriminate dispersed camping, active invasive vegetation control, more controlled grazing, and active vegetation management that

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are expected to improve the conditions of riparian habitat at Banks Lake. These actions will tend to offset some of the minor impacts associated with the potential 10-foot drawdown as disturbance associated with the drawdown is offset by the elimination of other disturbances to shoreline vegetation.

The Bass Anglers Sportsman Society (BASS) Federation of Washington State submitted a plan to Reclamation and the State outlining a plan to restore and enhance shoreline vegetation and to provide subsurface structure to enhance the survival of fish fry in Banks Lake. The plan has been accepted by Reclamation and the State, and several of the projects outlined in the plan have been started. By making slight changes in the proposal, such as the location of the underwater habitat improvements and possible changes to types of vegetation to be planted, it is anticipated that this plan will tend to help offset some of the minor impacts associated with the potential 10-foot drawdown. It is anticipated that the BASS plan will improve shoreline vegetation and would not be affected by the Action Alternative.

Fish and Wildlife

Among the goals of the Banks Lake RMP (Reclamation 2001) is the improvement and maintenance of fish and wildlife habitat. The RMP did not address any specific improvements to fish habitat but attempted to ensure that human actions did not detract from primary spawning habitat for fish. A number of actions involved in the RMP are directly related to improving and maintaining the terrestrial habitat for a variety of species. As an example, the limiting of dispersed camping to designated sites should concentrate human impacts to fewer areas. The potential 10-foot drawdown is not anticipated to affect any of the improvements or maintenance items outlined in the RMP.

The BASS Federation plan addresses both underwater structure and shoreline vegetation with the goal of improving the fish habitat within Banks Lake. By making slight changes to the location of the underwater structure and the selection of vegetation, the potential 10-foot drawdown should not affect the positive aspects of the BASS plan. The work involved in the plan should help to offset any minimal impacts to the fishery that the proposed drawdown may have by supplying underwater structure in those areas where young fish might be flushed from emergent vegetation.

Recreation

Historically, elevation changes to Banks Lake affect the availability of recreational resources surrounding the lake. Banks Lake is recognized locally and regionally for its diverse and outstanding recreational opportunities. These opportunities exist throughout the area for camping, swimming, boating, picnicking, and other recreational pursuits under the No Action Alternative.

Nineteen developed recreation areas are currently provided by a variety of public agencies and private entities. These areas are served by a wide range of developed day and overnight recreation sites and facilities, and generally are concentrated at the south and northeast ends of the reservoir. Of the 19 developed recreational areas, 12 maintain usable boat launches. Drawing the lake down lower than 1565 feet would negatively affect some recreational facilities and operations on the lake.

Anadromous Fish

The NMFS BIOP (NMFS 2000) was based among other things on maintaining certain flows at McNary Dam. The flow target is achievable only with water coming from a variety of sources. But during August of many years, the flow target is not achievable without utilizing additional water from storage. To supplement flows during August, the action agencies will add water to the river from a number of sources, including (according to the proposed action) Banks Lake. While individually not significant in the overall flow of the Columbia River, the contribution to that flow by Banks Lake water, coupled with water from other sources, makes it possible to meet flow targets a majority of years.

Unavoidable Adverse Impacts

Unavoidable adverse impacts are assumed to be long-term impacts to resources which would be affected by implementation of the proposed action. No significant unavoidable adverse impacts are expected as a result of implementing the proposed action. Minor changes in littoral and riparian communities may occur.

Relationship Between Short-Term Uses and Long-Term Productivity

This analysis examines the relationship between short-term uses of environmental resources and the maintenance and enhancement of long-term productivity.

As compared to the No Action Alternative, the Action Alternative would reduce pumping to Banks Lake by 127.2 kaf and increase Columbia River flows in August. The resulting reduction in Banks Lake surface elevations from 1565 feet to 1560 feet would result in temporary adverse effects by making boat ramps, mooring docks, and shallow channels unusable. Swimming beaches may also be unusable during the lower water surface elevations. These impacts would most likely result in decreased visitors to the lake in August and early September. However, Reclamation proposes to mitigate these impacts by extending the boat ramps, modifying the mooring docks, dredging deeper channels, and modifying or changing the location of the swimming beaches. Therefore, these impacts should not affect the long-term recreational use of the lake.

The Banks Lake water would be used to augment the flows in August when salmon flow objectives at McNary Dam are 200,000 cfs. This flow objective is intended to primarily benefit Snake River fall chinook salmon. The Snake River fall chinook juvenile migration tends to peak in mid-July with numbers tapering off into mid-August. Nearly half of the Snake River fall chinook can be transported from the Snake River collector dams and may not benefit from flow augmentation from the Columbia River. In addition, there is some uncertainty surrounding flow augmentation benefits for fish survival. Snake River fall chinook is one species that appears to have a stronger flow survival relationship, although that survival relationship is also influenced by water temperature and turbidity. It is hoped that the additional August flows will enhance the Snake River fall chinook populations.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments are decisions affecting renewable resources such as soils, wetlands, and riparian areas. Such decisions are considered irreversible, because their implementation would affect a resource that has deteriorated to the point that renewal can occur only over a long period of time or at a great expense, or because they would cause the resource to be destroyed or removed. Reclamation's decision to choose the Action Alternative, lowering the surface of the reservoir elevation to 1560 feet in August, would not result in an irreversible commitment of resources because (1) depending on Reclamation's operational and other needs, the August elevations may not be lowered to elevation 1560 feet, and (2) no renewable resources would be adversely impacted by the lowering the August surface elevations.

Irretrievable commitments of natural resources occur when a decision causes a loss of production or use of resources. They represent opportunities foregone for the time that a resource cannot be used. The primary impacts that would be irretrievable are those that involve physical processes and resources, such as water storage. Under the Action Alternative, a maximum of 127,200 acre-feet of water may be kept out of the reservoir and left in the Columbia River during August. In such circumstances, water for some of the available recreational uses in the reservoir would be lost to water used for the benefit of anadromous fish. However, because during certain conditions, Reclamation's operational and other needs may require that the water remain in the reservoir, existing recreational uses of the reservoir would not be irretrievably lost. Therefore, no irretrievable impacts would result from the implementation of the Action Alternative.

